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Analysis of Metal Powder Compaction by Differential Speed Rolling*

by

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Abstract

An admissible velocity field involving arbitrary variables for differential speed rolling of metal powder is newly proposed under some basic assumptions. The main assumption is that the plane perpendicular to rolling direction about the powder position where the densification starts advances toward the roll exit by gradually changing in its inclination. The total energy dissipation rate involving variables is calculated using the mechanics of powder compaction and the proposed admissible velocity field. On the basis of the total energy dissipation rate, an analysis of differential speed rolling of copper powder is carried out using the upper bound method to clarify the process characteristics. A minimizing technique of the total energy dissipation rate is presented under the given rolling conditions. The effects of influential factors such as roll speed ratio, initial roll gap, powder feed rate and strip speed at roll exit on the rolling load, strip thickness and relative density are evaluated. The predicted results, taking account of mill spring, agree well with experimental results obtained under carefully regulated powder feed rate. The availability of the proposed admissible velocity field is thus confirmed

Keyword : powder forming, powder rolling, differential speed rolling, admissible velocity field, energy dissipation rate, upper bound method, rolling load, relative density, strip thickness

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＊ 上界法による金属粉末の異速圧延に関する解析 その１ 可容速度場とエネルギ消費率
Journal of the JSTP vol.40 no.456 (1999) p65-68 広畑，眞崎，島
上界法による金属粉末の異速圧延に関する解析 その２ 計算結果と考察
Journal of the JSTP vol.40 no.456 (1999) p69-73 広畑，眞崎，島
上記２論文の英訳